

Groundwater resource appraisal for South-East Melbourne, Victoria

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Introduction

Southern Rural Water Authority commissioned Parsons Brinckerhoff to undertake a groundwater resource appraisal of the superficial aquifer in the south-east region of Melbourne, Victoria. Greater focus has been placed on Victoria's groundwater resources over the last 5 years. This has been driven in part by a growing awareness of the importance of groundwater to the community and the environment and by increased pressure on groundwater resources due to prolonged low rainfall conditions. The study aimed to progress the conceptual understanding of these aquifers, the volume of water that can reasonably be extracted and optimise the ongoing management of this resource.

The study area covered approximately 1200 km² of south-east Melbourne and the Mornington Peninsula, comprising the Quaternary and Tertiary age sediments. Three Groundwater Management Area's (GMAs) currently exist within the study area: Moorabbin, Frankston and Nepean. The total permissible consumptive volume (PCV) of the three GMAs is 11,913 ML/year. The groundwater is used for a variety of purposes including agricultural irrigation, golf course irrigation and stock and domestic. Groundwater also sustains a number of groundwater-dependent ecosystems within the study area and, as the study area is adjacent to Port Phillip Bay and Bass Strait, is potentially prone to sea water intrusion.

The study area was divided into five sub-catchments, based on watersheds. The study was based on already existing data sets such as previous resource assessments for the area, long-term rainfall and stream flow data, groundwater monitoring data from numerous previous investigations in the study area, groundwater usage data, and water inflows and outflows from urban water supply and wastewater infrastructure.

Preliminary findings

The average rainfall over the study area during the period 1997 to 2009 has reduced by an average of 140 mm when compared with the period 1970 to 1996. It is still unclear what overall impact this has had on the groundwater resource. Investigations are now being conducted to assess changes in groundwater levels since 1970.

A large proportion of the study area is urbanised and this had an impact on calculating recharge. Although built-up areas limited the amount of direct recharge from rainfall (due to paving and roofs) there were increases in recharge due to the anthropogenic effects. Leakage from the water supply network and from septic tanks was found to be the most significant component. Integrated water infrastructure is potentially providing up to 4,000 ML/year across the whole study area and septic tank in the Nepean area contributing up to a further 3,000 ML/year.

Recharge from rainfall was most successfully calculated using the Meyboom method, which considers seasonal changes in river baseflow. There was sufficient river hydrograph data for approximately one third of the study area to reasonably determine recharge from this method. In these areas, the recharge rate was estimated at between 10 and 30 mm. In other areas, such as the Mornington Peninsula, recharge was determined to be closer to 150 mm from empirical evidence. Additional methods of recharge estimation are required to validate these results.

An analysis of the potential extraction rates of groundwater via licensed and stock and domestic bores in the study area has been completed. The Nepean area has the most growth in S & D bores (40% of total licences in this area have been granted in the last 5 years) and more than 60% of the total potential extraction (3,700 ML from S & D bores and 9,463 ML from licensed bores).
